Critical Care Decision Support System

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Background. Therapeutic management based on protocols, and clinical algorithms is increasing in significance as medicine tackles more serious illness and must do so in cost-efficient manner. The most urgent problems in high risk surgery and trauma are early detection and more explicit physiologic description of correctable circulatory problems, and better criteria for prompt titration of therapy to maximize effectiveness. The management of circulatory failure in critically ill post operative patients, has some characteristics which requires for a different approach to case-base reasoning than other areas of medical care. The data is dynamic and is received incrementally, only a relatively low number of key medical conditions of the patient is monitored, data sampling is not periodic and system behaves reactively, that is the course of illness is altered by therapeutic interventions.

System. In this project we built a real time system which assist clinicians in protocol-based patient management by evaluating a patient's clinical and physiologic status, and providing prioritized lists of the program's reasoning. Ideally, predictors should be based on data obtained as early possible and they should be constructed from circulatory alternations that are close to the primary underlying mechanisms.

We developed a perception-action model to represent the patient. We defined each state based on expert's knowledge and developed a rule base system to suggest best treatment based on patient history. Using modern knowledge representation techniques, it will be possible to represent extensive algorithms to represent explicitly the knowledge that underlies the process of decision-making encoded in the algorithms, the concept of the treatment, and the details of the myriad etiologic and physiologic conditions that evolve over time. To address this issue we developed a Perception Action model which employs Finite State Transition (FST) model to represent changes in the situation , based on intervention and rules in a specific situation. The current model acts based on patient's response to each therapy and discovers all patient's states. The Action-Perception model is a behavioral model that relies on the patient's condition and treatment.

Evaluation. We report the result of an implementation of this system to work with an impressive database collected during past 15 years. We ran the system over more than 1000 patients . The result are encouraging and show that while the actual therapy given reduced the probability of survival in 36% and 38% of survivors and nonsurvivors, respectively, the recommended therapy reduced the probability of survival and nonsurvival in only 18% and 16% of the survivors and nonsurvivors, respectively and improved or had no significant change in 82% and 84%, respectively.

Conclusion. With the increasing emphasis on real-time decision support systems, there is an accompanying need for reasoning methods that can operate within limited time bounds. In this project we report a Decision Support System as a general form for any protocol based Decision Support System and we applied in the field of Critical Care. We employed different techniques such as temporal reasoning and case based reasoning methods and we show by employing such system we can improve in the quality of Heath Care specially in Protocol Based domains like Critical Care.

References

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